CC1110-CC1111DK
CC2510-CC2511DK
Development Kit

User Manual

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1 Introduction

Thank you for purchasing a SmartRF®04DK Development Kit.

Please note that Texas Instruments uses the term SmartRF®04DK as a collective term for all development kits on the Chipcon SmartRF®04 platform. This development platform supports evaluation, development and prototyping using the Chipcon SmartRF®04 products from Texas Instruments.

Make sure to subscribe to the Low-Power RF eNewsletter to receive information about updates to documentation, new product releases and more. Sign up on the Texas Instruments RF/IF Components web site.

2 About this manual

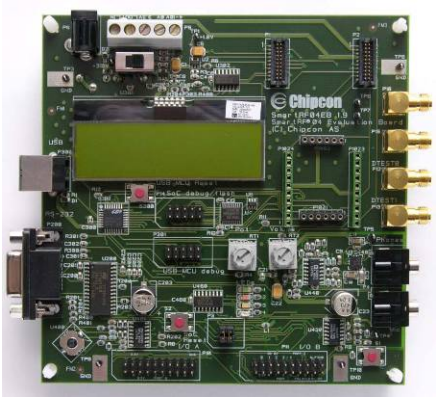
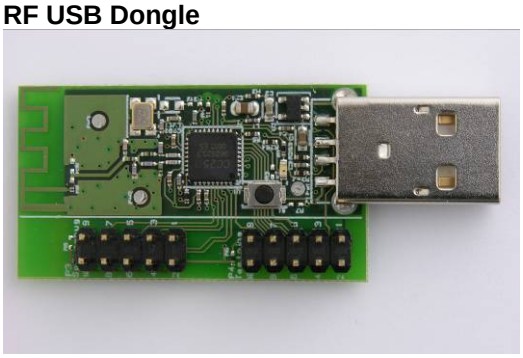
This manual contains both tutorial and reference information, and covers both the hardware and software components of the development kit.

Note that the RF USB dongle HW (CC1111 or CC2511) and application examples are covered in a separate document.

Both SmartRF® Studio and the Chipcon Flash Programmer have their own user manual.

Further background information can be found in the device datasheets.

3 Definitions

SmartRF04EB  Evaluation Board. Main board with LCD, USB interface, LEDs, pot-meter etc. Platform for the Evaluation Modules (EM).	**CC1110EM or CC2510EM** CC1110/CC2510 Evaluation Module, a small plug-in module for CC1110-CC1111DK/CC2510-CC2511DK, should be used as reference design for antenna and RF layout.
RF USB Dongle  Reference design for a CC1111 or CC2511 based USB dongle with RF interface. Should be used as reference design for antenna and RF layout. Note that the USB dongle is covered in a separate user manual.	

SmartRF®04DK	A collective term used for all development kits for the SmartRF®04 platform, i.e. SmartRF®04EB + EM.
USB MCU	The Silicon Labs C8051F320 MCU used to provide a USB interface on the SmartRF04DK.
Factory firmware	The firmware that is supplied programmed into the USB MCU from the factory. This firmware supports SmartRF® Studio operation as well as a stand-alone PER tester.
PER	Packet Error Rate. Counts the number of lost and/or faulty packets and displays the ratio: (lost/faulty packets)/number of packets sent.
SoC	System on a Chip. A collective term used to refer to Texas Instruments ICs with on-chip MCU and RF transceiver. Used in this document to reference the CC1110 / CC2510.
ICE	In Circuit Emulator.

4 Kit content

4.1 Hardware

The development kit contains the following:

- 2 x SmartRF®04EB
- 2 x CC2510EM evaluation modules in the CC2510-CC2511DK
- 2 x CC1110EM433 and 2 x CC1110EM868-915 evaluation modules in the CC1110-CC1111DK
- Antennas for the appropriate frequency range
- 1 x USB dongle
- 2 x USB cables
- 1 x USB extension cable
- 1 x 10-wire flat cable for using SmartRF®04EB as emulator for external target systems
- 1 x SOC_DEM System on Chip debug plug-in board
- Quick start guide

SmartRF®04EB with EM

The SmartRF04DK Development Kit includes a number of functions and applications that allows quick testing of the RF interface and peripherals of the chip.

- Evaluate the SmartRF®04 products. Right out of the box, the kit can be used for range testing.
- Use SmartRF® Studio to perform RF measurements. The radio can be easily configured to measure sensitivity, output power and other RF parameters.
- Prototype development. The SmartRF04DK includes a USB interface that can be used as emulator interface for the CC1110/CC2510. All CC1110/CC2510 I/O ports are available on pin connectors on the edge of the board to allow external applications easy access to the CC1110/CC2510. These connectors are also compatible with logic analyser probes for easy debugging.

5 SmartRF®04EB

This chapter includes overall information that applies to SmartRF®04EB. In the following SoC means Chipcon System on Chip, i.e. CC1110 or CC2510.

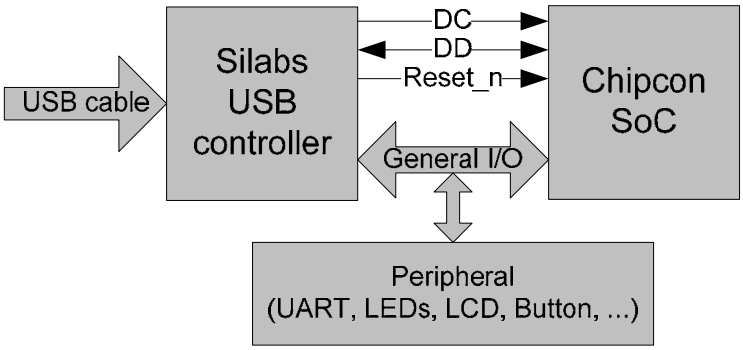


Figure 1: Main components

Figure 1 shows the main components on the SmartRF®04EB. A USB cable from a PC is connected directly to the USB controller. When a SoC evaluation module is plugged into the SmartRF®04EB, the only purpose of the USB controller is to “translate” USB signals to the SoC 2-wire debug interface. This interface includes Debug Clock (DC) and Debug Data (DD). The USB controller also controls the Reset_n line connected to the SoC.

Most of the peripherals on the SmartRF®04EB are connected to both the USB controller and to the SoC. This means that I/O ports on both controllers can drive the same pin. When the USB controller detects that a SoC is connected, it will therefore set all the I/O in three-state (high impedance) mode. The connection to the USB controller may anyhow somewhat influence these I/O lines.

5.1 USB MCU

5.1.1 Bootloader

The USB controller is programmed with a bootloader when it is shipped from the factory. The bootloader allows programming of new code into the USB MCU without the Silicon Labs' serial adapter. The bootloader communicates with SmartRF® Studio or a custom program via USB.

5.1.2 Programming USB controller

If it is required to update the firmware of the USB MCU, this can be done using the SmartRF®04 programming software (Chipcon Flash Programmer or SmartRF® Studio). For use of Chipcon Flash Programmer please refer to Chipcon Flash Programmer user manual for instructions. The USB controller can only be updated via USB when no EM is connected to the SmartRF®04EB.

To download firmware to the USB MCU without using the bootloader or to download the bootloader in the first place, a Silicon Labs' EC2 serial adapter (Figure 2) is required. This adapter should be connected to P301, marked "USB MCU debug", on the SmartRF®04EB.

Figure 2: EC2 serial adapter

5.2 USB MCU signal names

The USB MCU is a C8051F320 from Silicon Labs. Please see the Silicon Labs web site for detailed information about this MCU.

The following table shows the usage of I/O pins on the USB MCU.

Pin no.	Pin name (USB MCU)	Signal name SmartRF®04EB	0-ohm resistor	Function
1	P0.1	P1.7/SO/GDO1/MISO	R117	SPI MISO signal, transceiver/transmitter SO/GDO2
2	P0.0	P1.5/SCLK	R115	SPI Serial clock
10	P3.0/C2D			USB MCU Debug pin
11	P2.7	P1.3/LED3	R113	LED3 (yellow), active low
12	P2.6	P0.4/RTS	R100	
13	P2.5	RS232_POWER		Turns RS-232 level converter on/off
14	P2.4	P2.0/LED_4	R120	LED4 (Blue), active low
15	P2.3	RESET_N		LCD Power on reset signal, SoC RESET
16	P2.2	SOC_PRESENT		Tells USB MCU whether a SoC is present. 0 = transmitter/transceiver 1 = SoC
17	P2.1	P0.6/JOY	R106	Joystick input (analogue coded voltage)
18	P2.0	P1.2/LED2	R111	LED2 (Red), active low
19	P1.7	P1.0/LED1	R110	LED1, (Green), active low
20	P1.6	P0.7/POT	R107	Potentiometer input
21	P1.5	P0.5/JOY_PUSH	R112	Joystick pushed
22	P1.4	P1.1/PWM_OUTPUT	R105	PWM audio output
23	P1.3	P0.1/BUTTON_PUSH	R101	Button pushed
24	P1.2	P0.0/MIC_INPUT	R104	Audio input
25	P1.1	P2.4/SCL	R124	I2S clock (for LCD)
26	P1.0	P2.3/SDA	R123	I2S data (for LCD)
27	P0.7	P2.2/GDO2/DC	R122	Transceiver/transmitter GDO3, SoC debug signal
28	P0.6/CNVSTR	P2.1/GDO1/DD	R121	Transceiver/transmitter GDO1, SoC debug signal
29	P0.5	P0.2/UART_RD	R102	UART RD
30	P0.4	P0.3/UART_TD	R103	UART TD
31	P0.3/XTAL2	P1.4/CSn/SS	R114	SPI slave select signal
32	P0.2/XTAL1	P1.6/MOSI	R116	SPI MOSI signal, Transceiver/Transmitter SI

Table 1: USB MCU pin-out

As mentioned in the table, the joystick output is coded as an analogue voltage. This has been done in order to save the number of pins required on the MCU to interface with the joystick. The SoC software libraries contain functions to decode the ADC values and indicate in what direction the joystick is moved. The push function of the joystick is treated as a separate digital signal.

6 Hardware description SmartRF®04EB

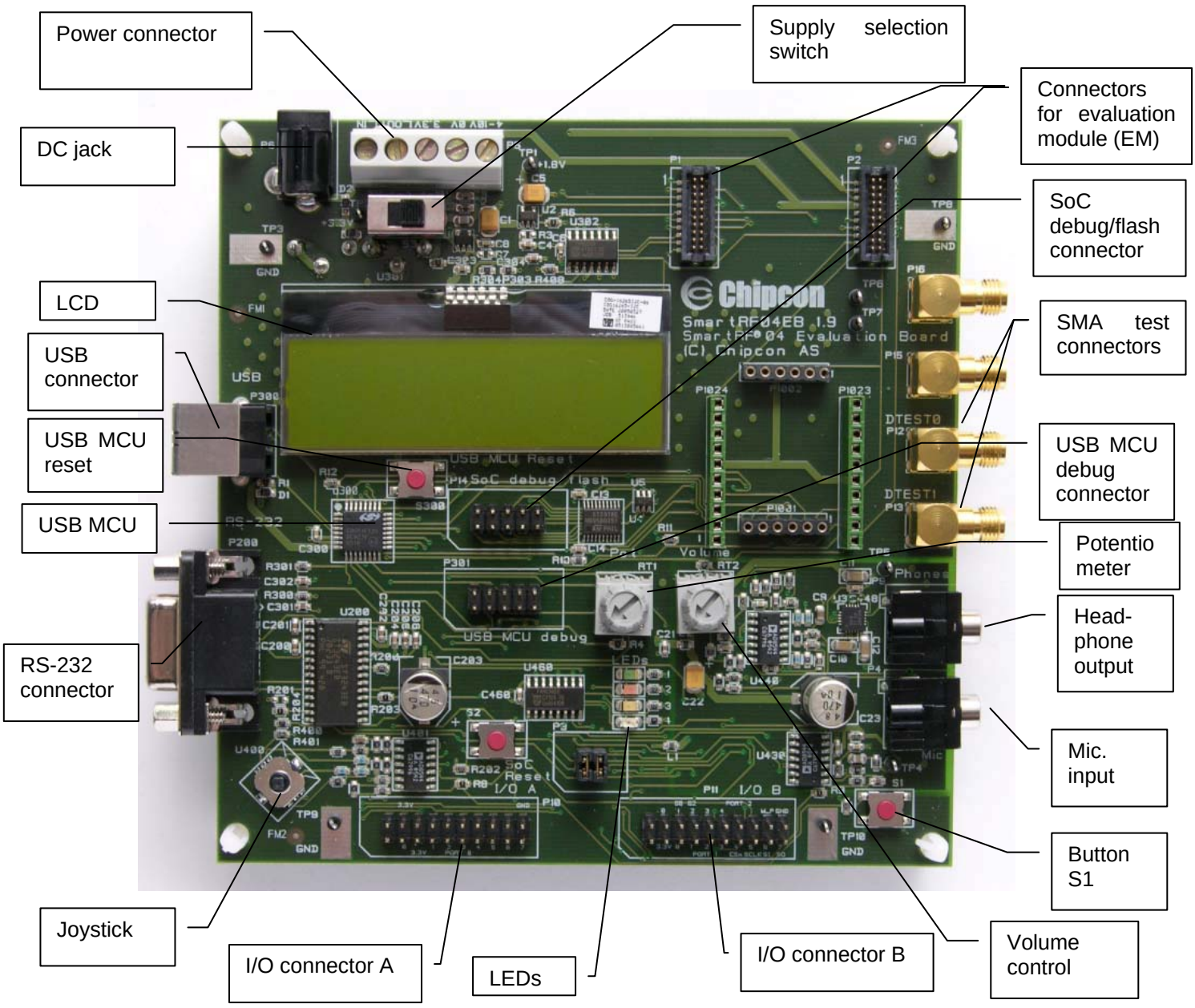


Figure 3: SmartRF04DK overview

The figure above shows the major parts of the SmartRF®04EB. The SmartRF®04EB serves as main platform in the development kit.

6.1 Powering SmartRF®04EB

If several power sources are connected to SmartRF®04EB, the board will be powered from the supply that supplies the highest voltage.

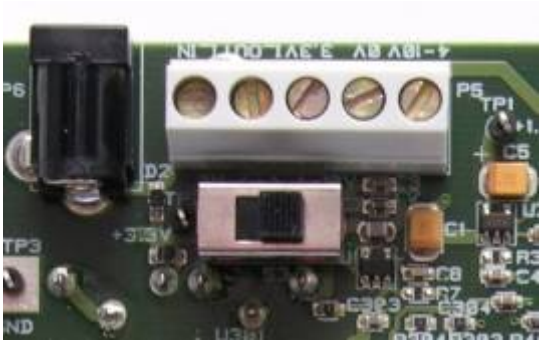


Figure 4: Power switch setting

The Power Switch S3 must be set according to what power source is used. If 3.3V is applied using the power terminal block, the switch should be set to the left position. In all other cases, the switch should be set to the right position for power to be applied to the SmartRF®04EB. This switch can be used to turn off the SmartRF®04EB by switching it to the opposite position of that used to turn it on.

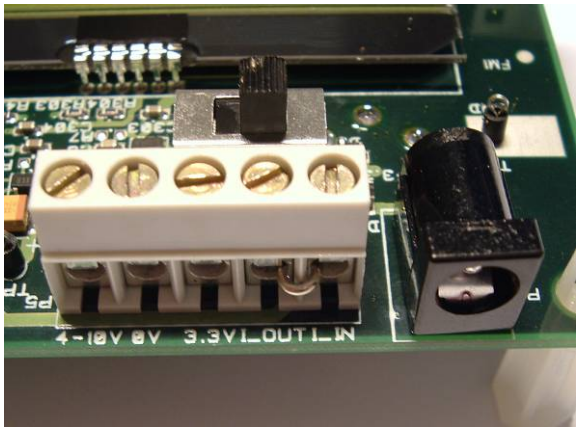


Figure 5: Power connector

The SmartRF®04EB can be powered in several different ways:

- **DC jack** connector with standard DC jack power connectors with a 2.5mm centre pin. The centre pin is used for the positive voltage. A 4-10V DC power supply should be used. The onboard voltage regulator supplies 3.3V to the board.
- **Laboratory power supply**. Ground should be connected to the 0V terminal on the power connector (see Figure 5). A 4-10V supply can be connected to the “4-10V” terminal, or a 3.3V supply can be connected to the “3.3V” terminal. The on-board voltage regulators will be bypassed when using the “3.3V” terminal. Therefore it is important that the voltage level is within these limits:
    - 2.7V-3.6V when the USB interface is not active.
    - 3.0V-3.6V when the USB interface is active.
- **USB power**. If the SmartRF®04EB is connected to a USB socket on a PC, it will draw power from the USB bus. The onboard voltage regulator supplies 3.3V to the board.
- **Battery power**. The evaluation board includes a 9V-type battery connector on the bottom side of the PCB. A 9V battery or a battery pack that uses a 9V-type connector can be connected to this battery connector. The onboard voltage regulator supplies 3.3V to the board.

Please note that while the SmartRF®04 devices have a wide supply range, the components on the SmartRF®04EB limit the total voltage supply range to 2.7V – 3.6V (3.0V – 3.6V while the USB is active). The SmartRF®04EB has been designed for a temperature range of –40°C to +85°C (excluding the LCD display). The EM is designed for a temperature range of -40°C to +85°C.

6.2 USB Interface

The USB interface is used to interface to a PC to run SmartRF® Studio and for programming and debugging using the PC debugging tools and programmers. If SmartRF® Studio connects to the SmartRF®04EB and detects an old version of the USB MCU firmware, the USB MCU will be upgraded via this interface. The SmartRF®04EB can be bus-powered from the USB interface.

6.3 RS-232 interface

The RS-232 can be used by custom applications for communication with other devices. The RS-232 interface utilises a voltage translation device so that the RS-232 port is compatible with bipolar RS-232 levels.

Note that this RS-232 level converter contains a charge-pump power supply that generates electrical noise. The RS-232 voltage converter can be disabled by driving pin P2.5 on the USB MCU low (the same pin is used to disable the headphone amplifier).

6.4 User interface

The SmartRF®04EB includes a joystick and a push button as user input devices, and four LEDs and a 2x16 character LCD display as user output devices. The display and user interface is by default controlled by the factory firmware in the SoC.

6.5 Audio interface

The SmartRF®04EB includes a microphone input and headphone output.

The audio output section consists of a volume control, followed by a 4^{th} order Chebychev filter. This filter serves to attenuate frequencies above 6 kHz, and so converts the PWM signal to an analogue audio signal. A headphone amplifier IC (TPA4411 from Texas Instruments) is used to drive the headphones.

Note that the headphone amplifier IC uses switch-mode power supply techniques to generate negative voltages, and this may cause electrical noise. The headphone amplifier can be disabled by driving pin P2.5 on the USB MCU low (the same pin is used to disable the RS-232 voltage converter).

The audio input section consists of a microphone amplifier that also includes a low-pass anti-aliasing filter. In order to use the audio/microphone input, a resistor (preferably 0 Ohm) has to be mounted at position R104 on the backside of the SmartRF®04EB. The R104 resistor connects the audio/microphone input (an analogue signal) to an associated EM pin. When a SoC EM is used together with a SmartRF®04EB, the audio/microphone input may generate interrupts and e.g. wake the SoC up from Power Mode 2. Therefore the R104 resistor is not mounted on SmartRF®04EB rev. 2.0.1 (and newer revisions). Note that the SmartRF®04EB revision is stated on a stick-on label located on the backside of the board.

A standard PC-type headset with separate microphone and headphone mini-jacks can be connected directly to the audio interface.

6.6 SPI interface swap jumpers on SmartRF®04EB

The SPI swap jumpers at P3 shall be set according to Figure 6.

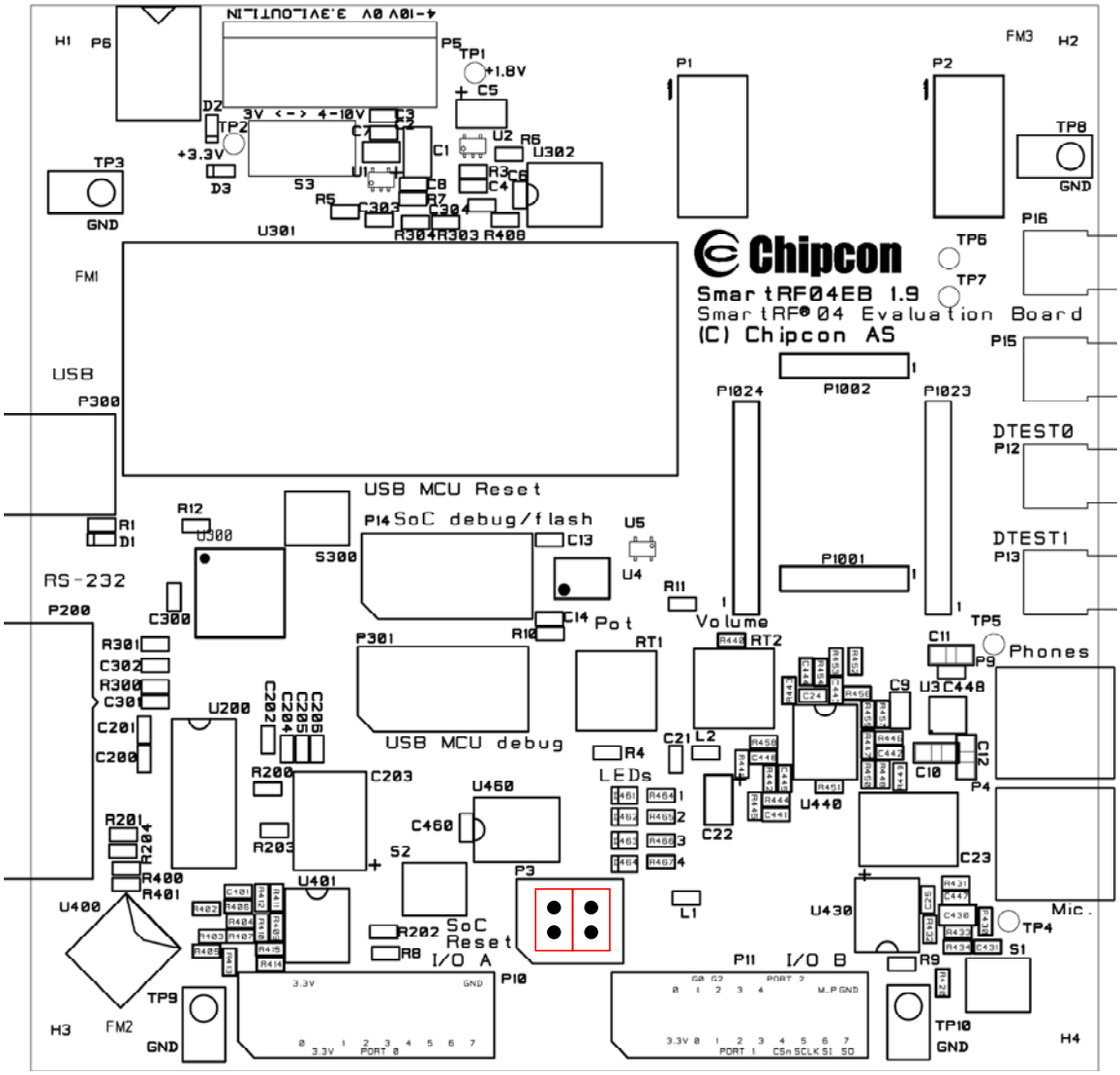


Figure 6: SPI jumper setting

6.7 I/O connectors

The I/O connectors bring out all the signals from the EM connectors. These connectors are compatible with Agilent logic analyser probes. The connectors allow easy access to I/O signals and to connect prototyping boards.

Pin	Function
1	N/C
2	N/C
3	P0_0/MIC_IN
4	VDD
5	VDD
6	N/C
7	P0_1/BUTTON_PUSH
8	N/C
9	P0_2/UART_RD
10	N/C
11	P0_3/UART_TD
12	N/C
13	P0_4/RTS
14	N/C
15	P0_5/JOY_PUSH
16	N/C
17	P0_6/JOY
18	N/C
19	P0_7/POT
20	GND

Table 2: I/O connector A (P10) pin-out

Pin	Function
1	N/C
2	N/C
3	VDD
4	P2_0*/LED4
5	P1_0/LED1
6	P2_1/DD
7	P1_1/PWM_OUTPUT
8	P2_2/DC
9	P1_2*/LED2
10	P2_3*/SDA
11	P1_3/LED3
12	P2_4*/SCL
13	P1_4/CSn
14	N/C
15	P1_5/SCLK
16	RESET_N
17	P1_6/MOSI
18	Debug Data Direction(DD_DIR)
19	P1_7/MISO
20	GND

Table 3: I/O connector B (P11) pin-out, * see chapter 6.10.

6.8 EM connectors

The EM connectors are used for connecting the EM to the SmartRF®04EB. The connectors P1 and P2 are used as the main interface.

The EM should be used as an RF reference design with the Chipcon SoC, decoupling, and all required RF circuitry. It is recommended to copy this reference design when designing applications with Chipcon RF devices in order to achieve best RF performance.

Note that while it is physically possible to plug an EM not belonging to the SmartRF®04 product range into the SmartRF®04EB, the factory firmware and SmartRF® Studio do not support the use of older devices. The SmartRF®04EB can be used with custom firmware for prototyping using older Chipcon RF devices.

6.9 Signal flow

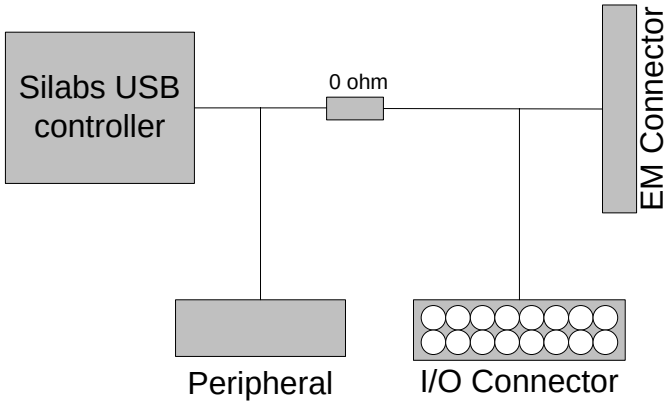


Figure 7: Evaluation Board Signal flow

The signal lines from the EM connectors run via 0-ohm resistors to the USB MCU and the various peripherals on the SmartRF®04EB. This allows connecting an EM module to other applications. The USB MCU can be disconnected from the signal pins by removing the 0-ohm resistors. The I/O connectors are located on the “outside” of the 0-ohm resistors, so they are still connected to the EM connectors even if the 0-ohm resistors are removed. Please refer to Table 1 on page 8 for a list of 0-ohm resistors and corresponding signals.

The SmartRF®04EB may not work with In-Circuit Emulator (ICE), SmartRF® Studio or the SW examples when the 0-ohm resistors are removed.

6.10 EM LCD connection

Please note that the I/O pins P2_3 and 2_4 on the SoC are connected to a 32 kHz X-oscillator on the CC1110EM and CC2510EM boards. The LCD display is therefore internally, on the EM, swapped from P1_2 to P2_3 and P2_0 to P2_4 as shown in Figure 8. Therefore there is no access to LED2 (red) and LED4 (blue) from the SoC.

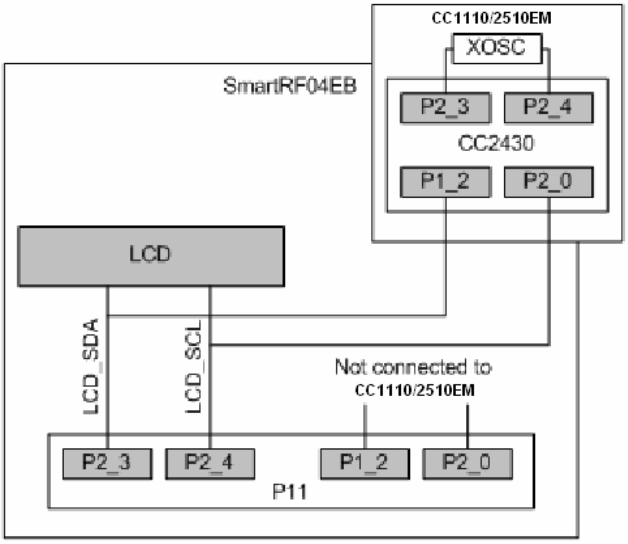


Figure 8: EM LCD connection

7 Application examples and RF testing

This section identifies what example software comes with the CC1110/CC2510 development kit and also describes how to use the kit for fundamental RF testing.

7.1 Setup

1. Plug two Evaluation Modules into the two Evaluation Boards.
2. Connect antennas to both EM boards
3. Apply power to the Development Kits. See chapter 6.1 for more information about various ways of powering the Development Kit.
4. Turn on power by setting the power switch correctly.

For a more detailed explanation, see the “Quick Start Instructions” for the development kit.

7.2 Examples

The CC1110/CC2510 development kit is accompanied by a Packet Error Rate (PER) software example. This together with a corresponding document can be downloaded from the Texas Instruments web site.

The software example is provided as source code. It is written for the IAR Embedded Workbench for 8051. It is necessary to have the Embedded Workbench installed to be able to compile or debug the source code or build binary files for download to the CC1110 or CC2510. Please see chapter 8 for installation and licensing details.

The Packet Error Rate (PER) is one way of describing the quality of a radio channel. A high PER indicates many lost or damaged packets, in other words bad transmission conditions. This example makes it possible to test the CC2510 and the CC1110 against the specifications in the data sheet in different transmission conditions and with various radio frequencies chosen from a menu.

When starting the example the Chipcon-logo, chip used and revision will be shown on the LCD. The application will start when button S1 is pushed.

7.3 RF testing

RF testing is best performed by using SmartRF® Studio together with the Development Kit. Connect the SmartRF04DK to a PC using the USB interface. Start SmartRF® Studio and select the SmartRF®04 tab. Select the correct Development Kit (several Development Kits can be connected to a PC at once), it should be listed as “CC2510 – new device” or “CC1110 – new device”, and click the Start button. In the main SmartRF® Studio window settings can be changed, tests performed and registers adjusted. RF measurement equipment may be connected to the SMA connector on the EM.

Please see the SmartRF® Studio documentation for more information about the operation of SmartRF® Studio.

7.3.1 Output power testing

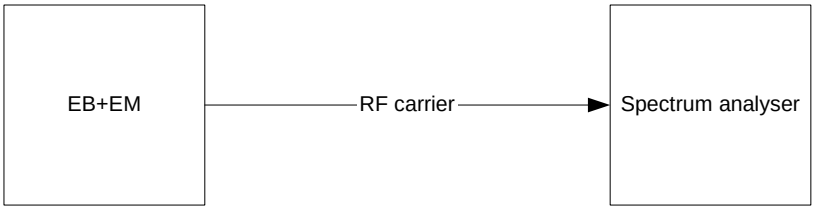


Figure 9: Output power measurement set up

Plug an EM into the SmartRF04DK, and connect the Development Kit to a PC using USB. Start SmartRF® Studio. Connect the antenna port of the EM board to a spectrum analyser using a 50-ohm RF coaxial cable. Use the simple TX function in SmartRF® Studio to set up the RF chip to emit a carrier at the desired frequency. An accurate measure of the output power can now be made. It is recommended to use a resolution bandwidth (RBW) of 3 MHz to ensure that all the RF energy is included in the measurement. Using good-quality RF cabling, the loss in the cabling should be negligible. However make sure that the spectrum analyser is calibrated. If possible, check it against a calibrated instrument such as an RF signal generator. Uncalibrated spectrum analysers can display errors of several dBs.

8 IAR Embedded Workbench

An evaluation version of IAR Embedded Workbench is included in the CC1110/CC2510 development kit. This chapter describes how to obtain an IAR license number, how to install the IAR evaluation version and how to obtain a license for 60 days additional evaluation.

The 60 days additional evaluation time is provided to all TI Low Power Wireless development kit customers.

8.1 Download the latest IAR software

The latest evaluation version of IAR Embedded Workbench for 8051 can be downloaded from: http://supp.iar.com/Download/SW/?item=EW8051-EVAL

8.2 Installation of downloaded evaluation version from web

Run the downloaded installation program and follow the instructions. You will have to register with IAR to get an e-mail with a link to a “Registration confirmed” web site. This is the web site that contains your license number and license key. An example is shown in Figure 10.

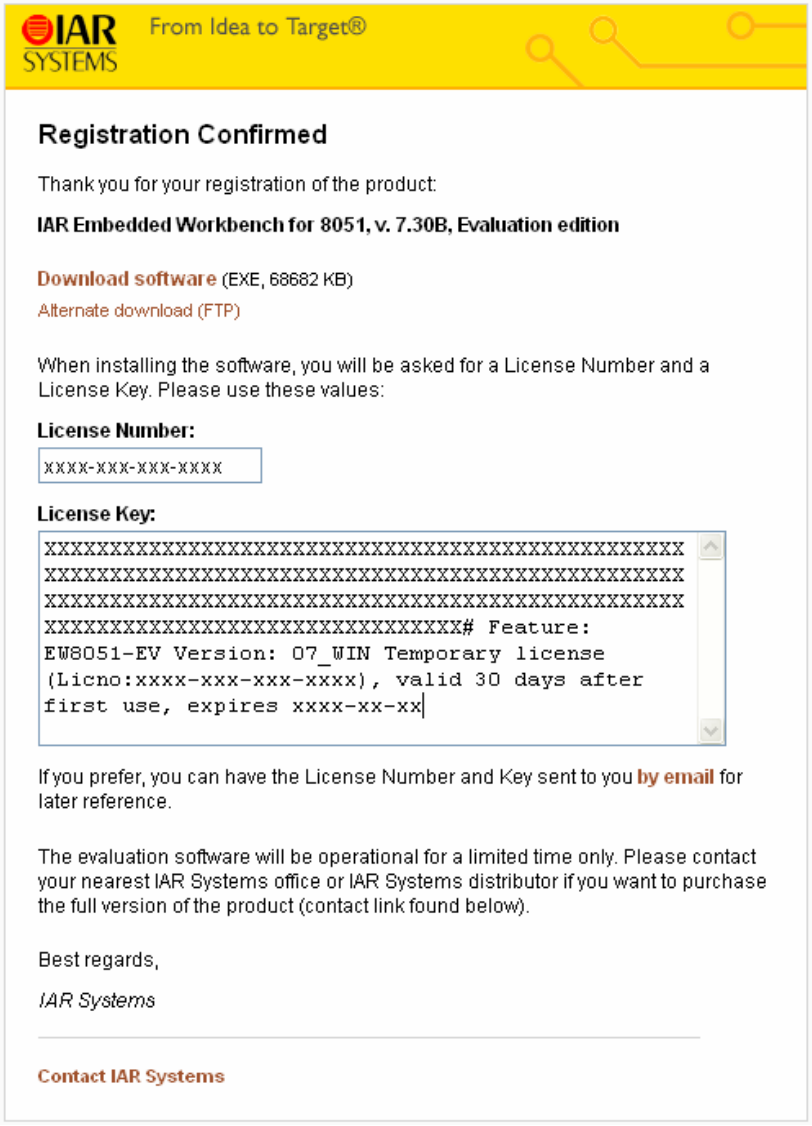

IAR SYSTEMS
From Idea to Target®
Registration Confirmed
Thank you for your registration of the product:
IAR Embedded Workbench for 8051, v. 7.30B, Evaluation edition
Download software (EXE, 68682 KB)
Alternate download (FTP)
When installing the software, you will be asked for a License Number and a License Key. Please use these values:
License Number:
XXXX-XXX-XXX-XXXX
License Key:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX# Feature:
EW8051-EV Version: 07_WIN Temporary license
(Licno:xxxx-xxx-xxx-xxxx), valid 30 days after
first use, expires xxxx-xx-xx
If you prefer, you can have the License Number and Key sent to you by email for later reference.
The evaluation software will be operational for a limited time only. Please contact your nearest IAR Systems office or IAR Systems distributor if you want to purchase the full version of the product (contact link found below).
Best regards,
IAR Systems
Contact IAR Systems

Figure 10: IAR registration confirmed web site example

The license number and license key from the “Registration confirmed” web page are required during the installation.

Please note that you shall use the license number from the “Registration confirmed” web site even though the installation program states that the license number can be found on the CD cover.

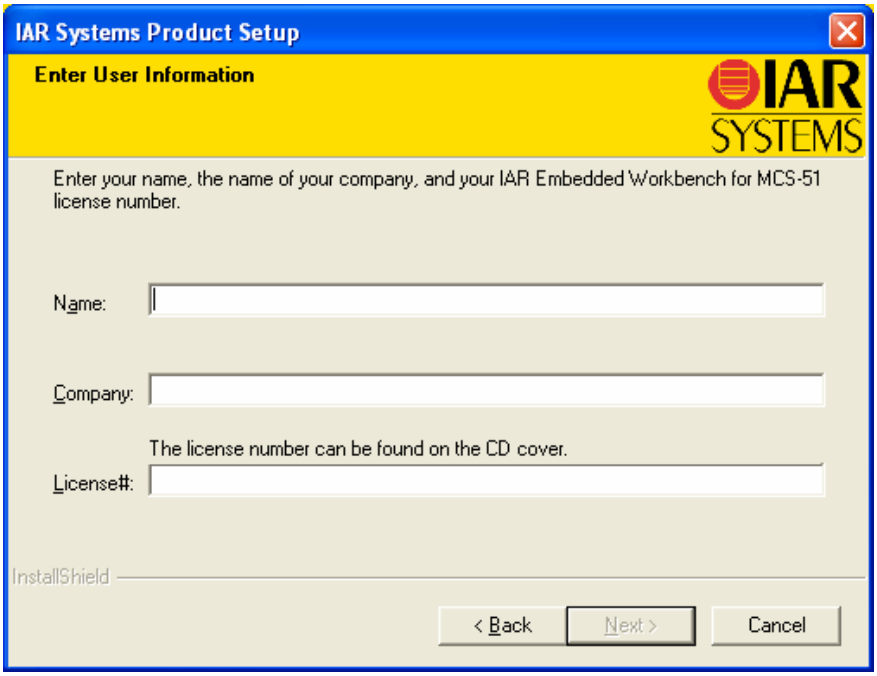

IAR Systems Product Setup
Enter User Information
IAR SYSTEMS
Enter your name, the name of your company, and your IAR Embedded Workbench for MCS-51 license number.
Name:
Company:
The license number can be found on the CD cover.
License#:
InstallShield
< Back
Next >
Cancel

Figure 11: IAR installation screen shot

8.3 Installation from the CD

It’s recommended to install the latest version as described above. But if you anyhow prefere to install from the IAR CD delivered with the kit, please follow the procedure below.

1. Insert the CD
2. Click “Install the IAR Embedded Workbench”

Figure 12: IAR installation from CD, step 1

3. Click “IAR online registration”

Welcome to the united world of IAR.
IAR Embedded Workbench™ Evaluation Installation
You must have a license number and an installation key in order to install this evaluation version of the Embedded Workbench.
Please follow these steps:
1. Click on the IAR online registration link below to register on the IAR website.
2. You will receive an e-mail with your license number and installation key within a few minutes.
3. Click on the Install the IAR Embedded Workbench™ link below to start the installation.
IAR online registration
Install the IAR Embedded Workbench™
Back
Different Architectures. One Solution.
IAR SYSTEMS
www.iar.com

Figure 13: IAR installation from CD, step 2

4. Follow the instructions given on screen. The registration and licensing procedure is equal to the procedure explained in chapter 8.2.

8.4 Obtaining 60 days additional license

To obtain a license for additional 60 days evaluation, please contact your local IAR sales representative. For a list of sales offices and distributors in your country, please see this site: http://www.iar.com/contact

8.5 IAR Embedded Workbench – KickStart edition

As an alternative to the time limited evaluation version, IAR also offers a code size limited version that you can use as long as you want. This is called the IAR Embedded Workbench – KickStart edition. The code size limitation for the KickStart edition for 8051 is currently 4 kB.

The kickstart edition of IAR Embedded Workbench is a code size limited but fully functional integrated development environment, ideal for creating small applications or for getting started fast on a new project. The kickstart eidition is completely free of charge and you may use it for as long as you want. The only requirement is that you register to get a license key.

The kickstart edition of IAR Embedded Workbench includes project manager, editor, C/C++ compiler, assembler, linker, librarian and debugger tools. A complete set of user guides is included in PDF format.

More information is found on this web site: http://www.iar.com/p89661/p89661_eng.php#ks. Please choose the version for the **8051 processor family / core**, not the version for the Texas Instruments MSP430 processor family / core.

9 Using SmartRF®04EB for prototyping

SmartRF®04EB includes a debug and programming interface. The debug interface is controlled by 2 communication pins. On the SmartRF®04EB the interface is controlled by the USB MCU. This allows both programming and an emulator interface using the USB port.

Table 1 on page 8 shows which pins on the MCU that are used for various peripheral functions. P10 and P11 pin-row connectors can be used to connect the SmartRF®04EB to another PCB or prototyping board.

9.1 Using SmartRF®04EB as an In-Circuit Emulator (ICE)

The SmartRF®04EB can be used as ICE both for devices connected to the EM socket and for external systems with custom applications. Figure 14 shows the main components on SmartRF®04EB when it's used as ICE. Please notice that if the SmartRF®04EB is used to debug an external system, the EM *shall be removed*, and vice versa. It is strongly recommended to use the SOC_DEM in the EM connector slot when the SmartRF®04EB is used to debug an external system, please see section 9.3.

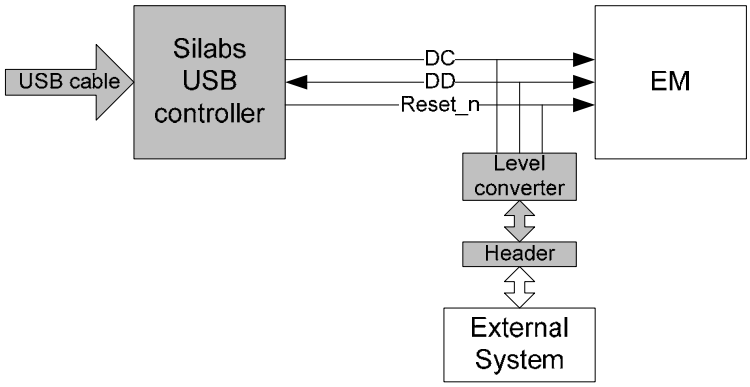


Figure 14: SmartRF®04EB used as ICE

If several SmartRF®04EB boards are connected to the PC USB ports simultaneously a selection window will display the connected SmartRF®04EBs, and the user can select which device to load. This is valid for all Chipcon PC software.

9.2 Debug interface

When designing PCBs with Chipcon SoC's it is recommended to include a pin header or test points to allow in-circuit emulation or programming using SmartRF®04EB or other programming tools.

The pin-out used on the SmartRF®04EB is explained in Table 4. The connector includes 4 SPI control signals. These are currently not used, but they are included for flexibility.

The SmartRF®04EB includes a voltage converter to support programming and debugging of external systems with different operating voltage than the SmartRF®04EB. The debug connector (P14, "SoC debug/ flash") includes two VDD connections on pin 2 and pin 9. The function is different for these connections.

Pin 2 VDD supplies voltage to the voltage converter. This pin should be connected to VDD, on the external board to assure that the correct supply voltage is used for the voltage converter. *This pin must always be connected.* The voltage on the target system must be above 2.7 V when debugged from SmartRF®04EB.

Pin 9 VDD supplies VDD (3.3 V) from the SmartRF®04EB. If the target application is powered from the SmartRF®04EB supply during programming and debugging this pin should be connected. If the target voltage differs from 3.3V, this pin should not be connected.

The pin out used on the SmartRF®04EB is explained in Table 4 and Figure 15. All signals in bold in the table are required. Figure 15 shows the required signals for a minimum connector layout.

Pin	Function	Note
1	**GND**	
2	**VDD**	Used to set correct voltage for the voltage level converter
3	**Debug Clock (DC)**	
4	**Debug Data (DD)**	
5	CSn	
6	SCLK	
7	**Reset_N**	
8	MOSI	
9	3.3V VDD, alt. NC	Delivers VDD from SmartRF®04EB
10	MISO	

Table 4: P14 SoC debug connector pin-out

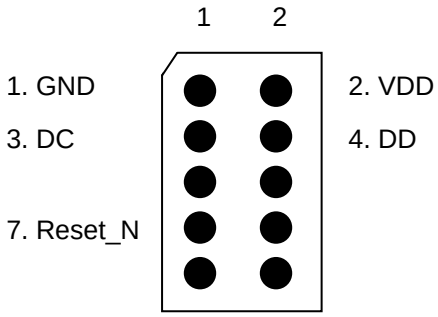


Figure 15: Recommended debug connector layout (Top view)

9.3 System-on-Chip Debug Plug-In board (SOC_DEM)

The CC1110/CC2510 DK is equipped with a System on Chip Debug Plug-in board (SOC_DEM) as shown in Figure 16.

The SOC_DEM provides an additional physical SoC debug/programming interface for the SmartRF®04EB. The board is included because the original debug interface on the SmartRF04®EB P14 is known to be unreliable in certain situations.

When programming and/or debugging a target board using the SmartRF®04EB as In Circuit Emulator (ICE) it is recommended to always use the SOC_DEM board in stead of the SmartRF®04EB P14 SoC debug/flash connector.

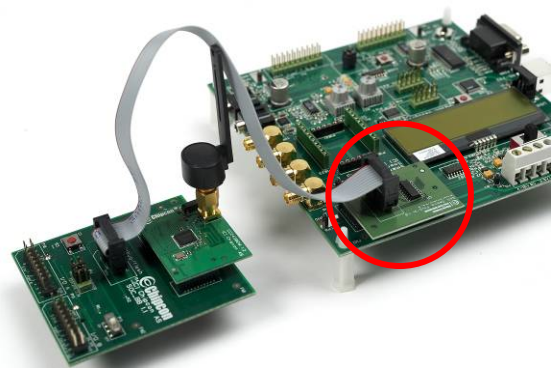


Figure 16: SOC_DEM board

Please note that the SmartRF®04EB P14 SoC debug/flash connector provides an SPI interface in addition to the Chipcon debug interface. This SPI interface is NOT provided by the SOC_DEM. However, it is neither needed for programming nor debugging of Chipcon System-on-Chip products.

10 Programming the SoC with a HEX file

The SoC can be programmed from the USB interface using the Chipcon programming software. Figure 17 shows the user interface of the Chipcon Flash Programmer. For additional information regarding the Chipcon Flash Programmer please refer to the Chipcon Flash Programmer User Manual.

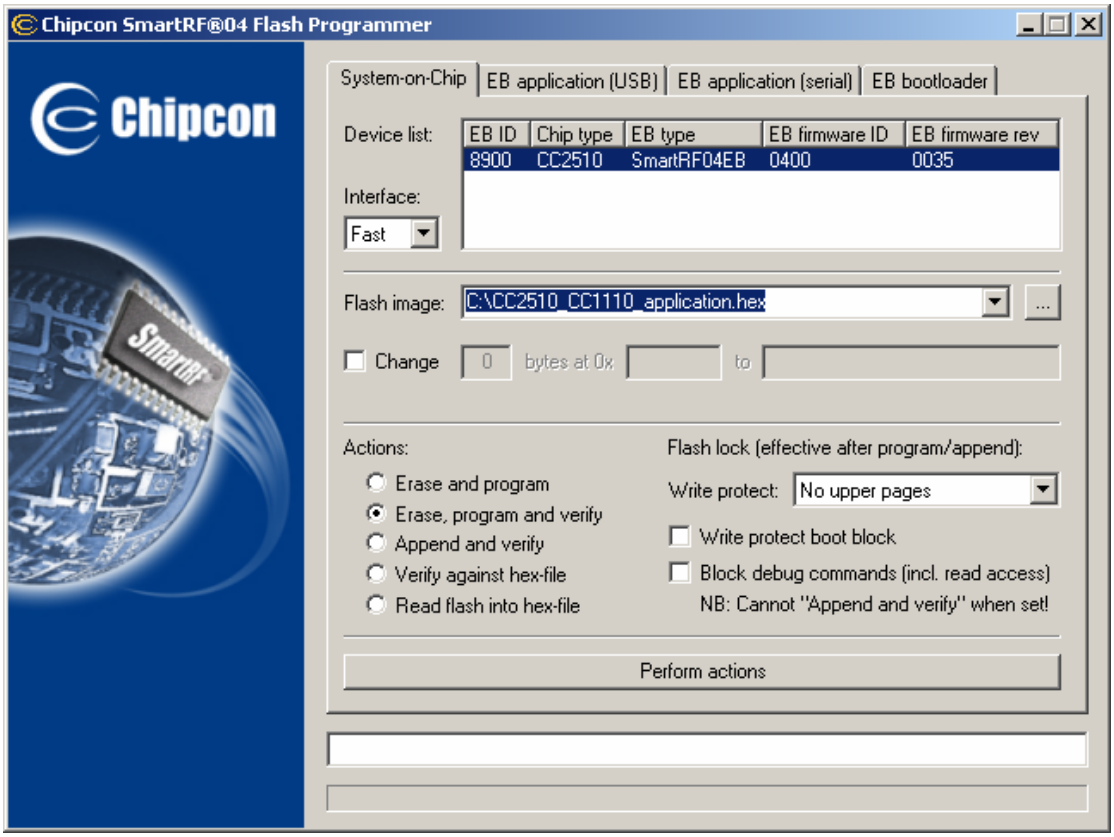


Figure 17: Chipcon Flash programmer software

11 SmartRF®04EB Troubleshooting

Please refer to Texas Instruments Design Note, DN300 for SmartRF®04EB troubleshooting:

DN300 - SmartRF04EB Troubleshooting

12 SmartRF04DK Schematics

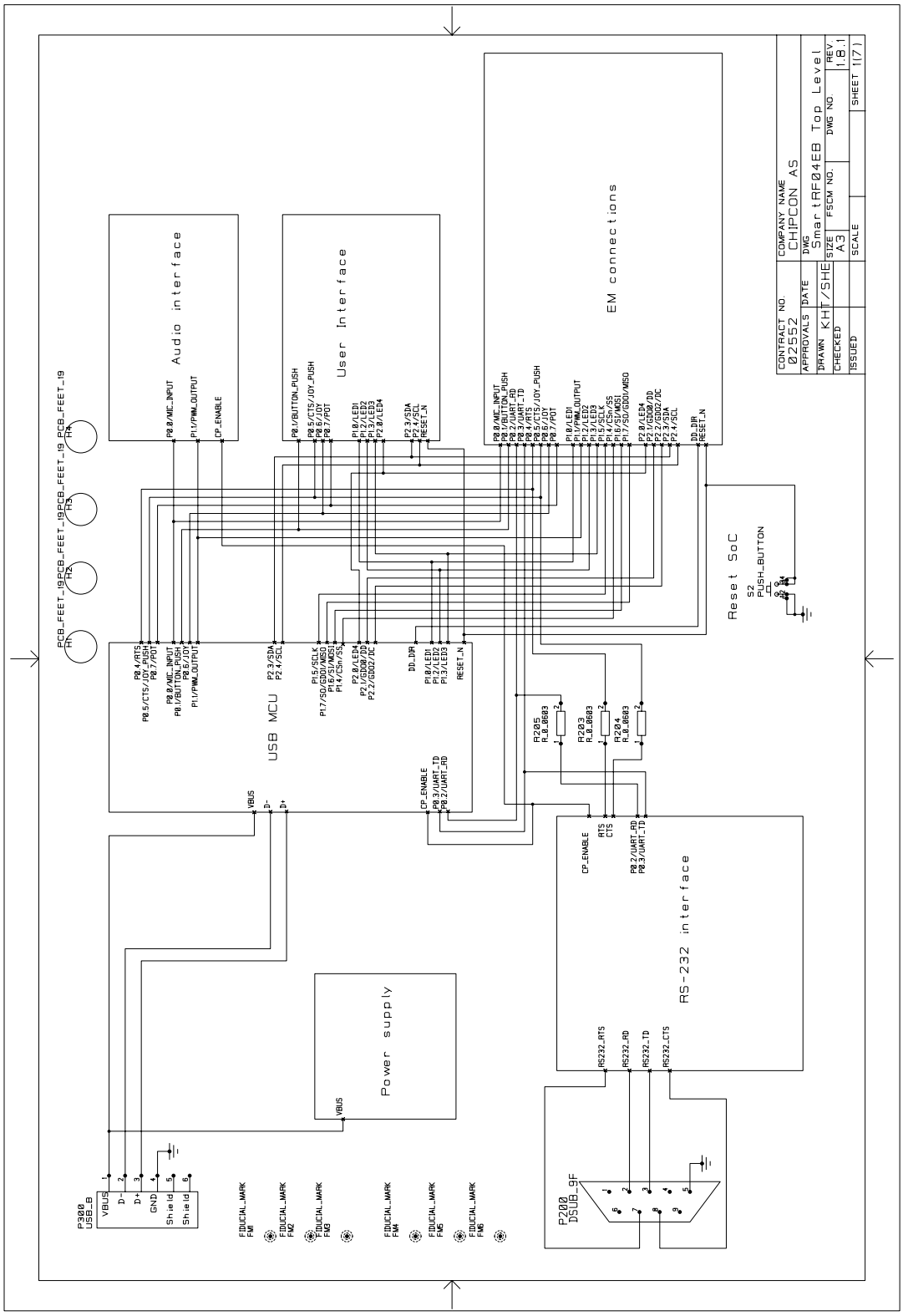


Figure 18: SmartRF®04EB schematic, page 1

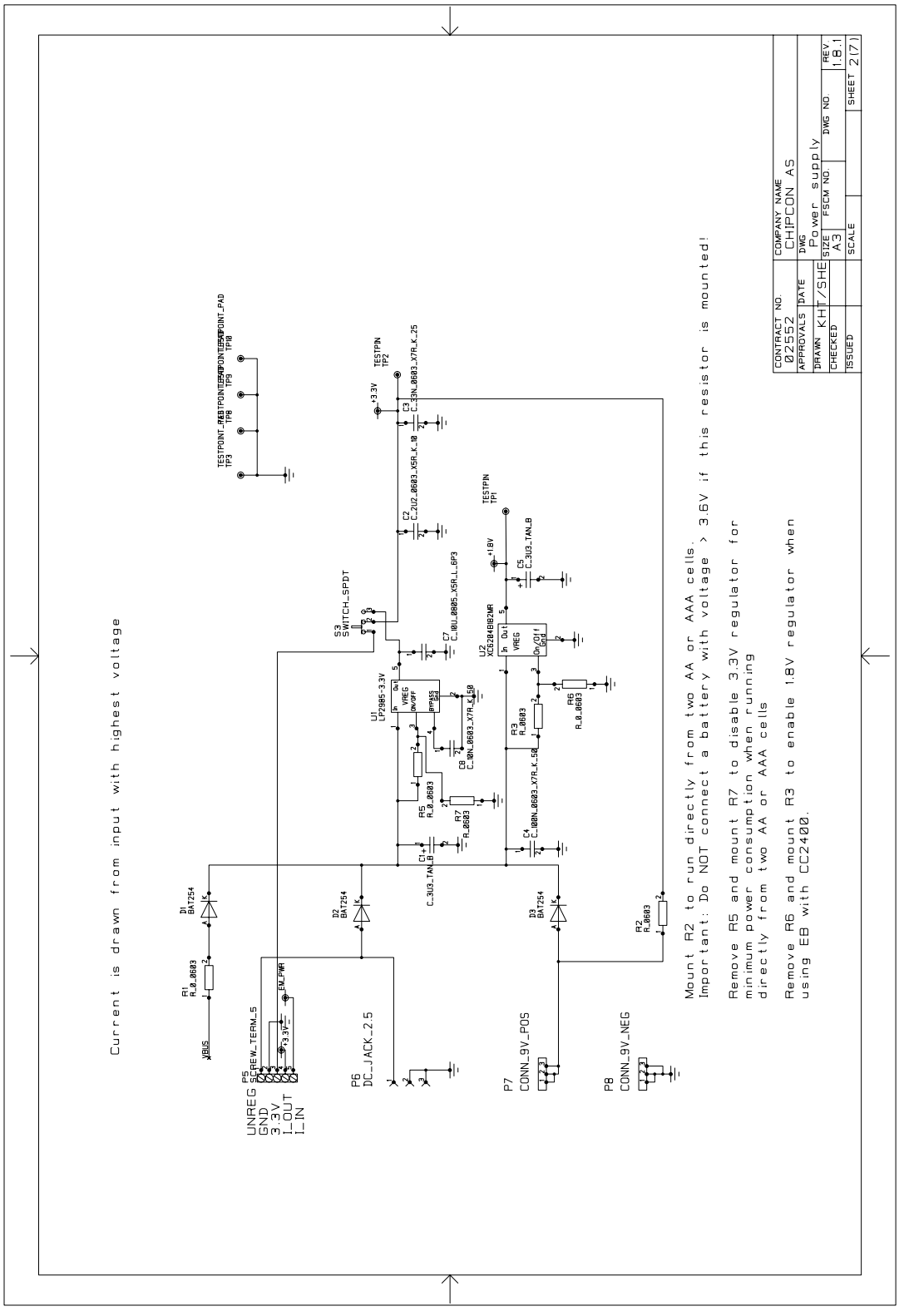


Figure 19: SmartRF®04EB schematic, page 2

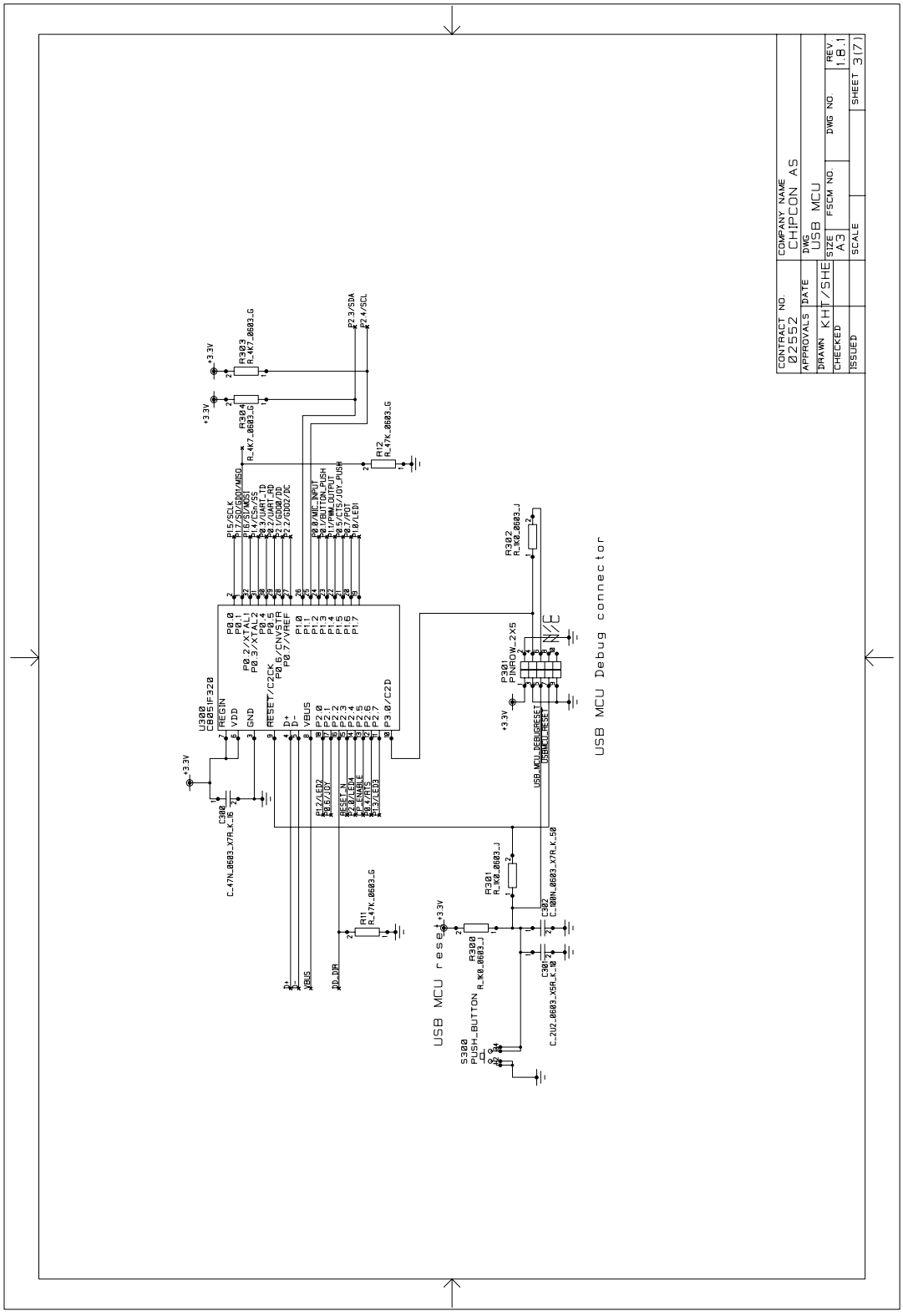


Figure 20: SmartRF®04EB schematic, page 3

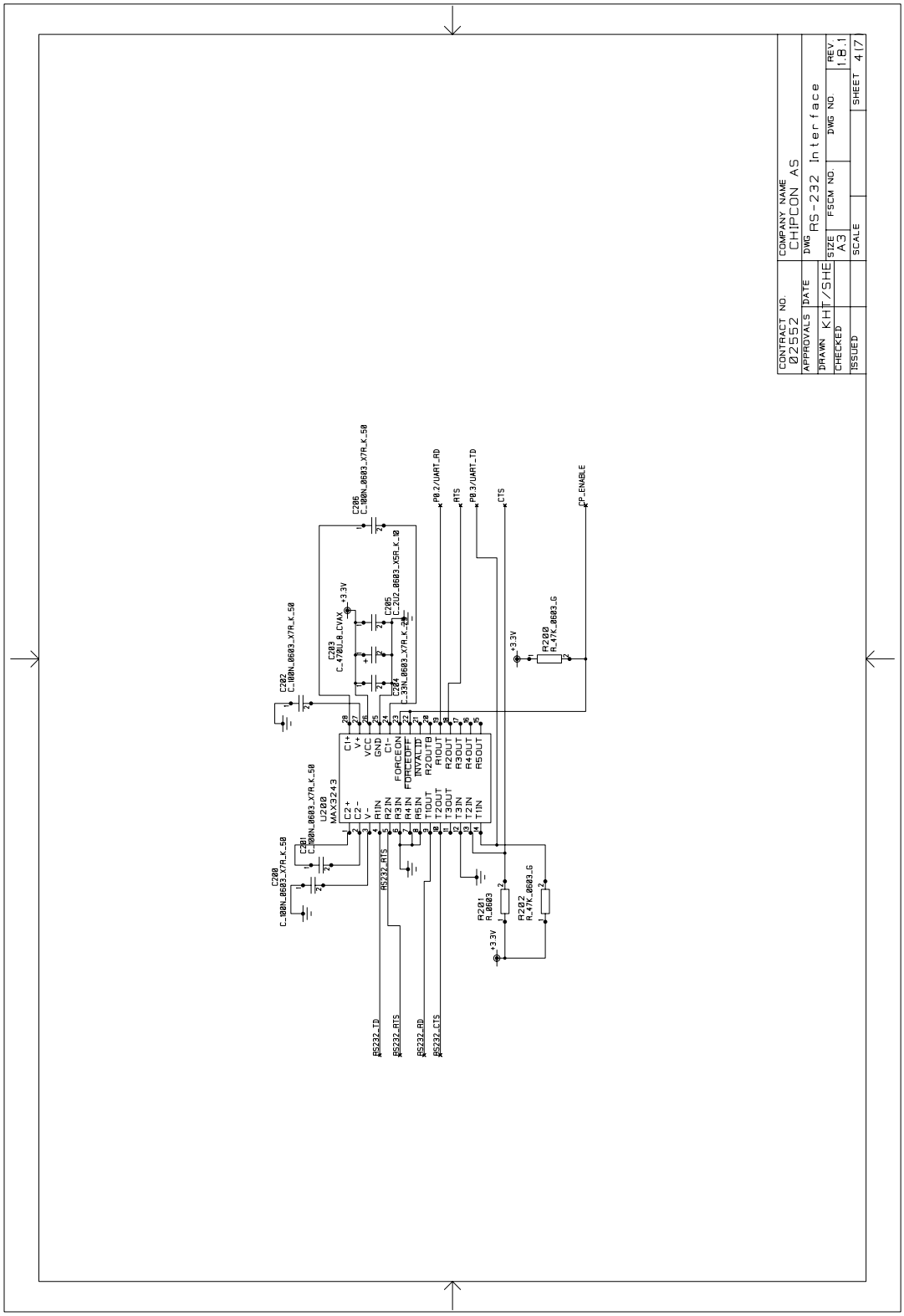


Figure 21: SmartRF®04EB schematic, page 4

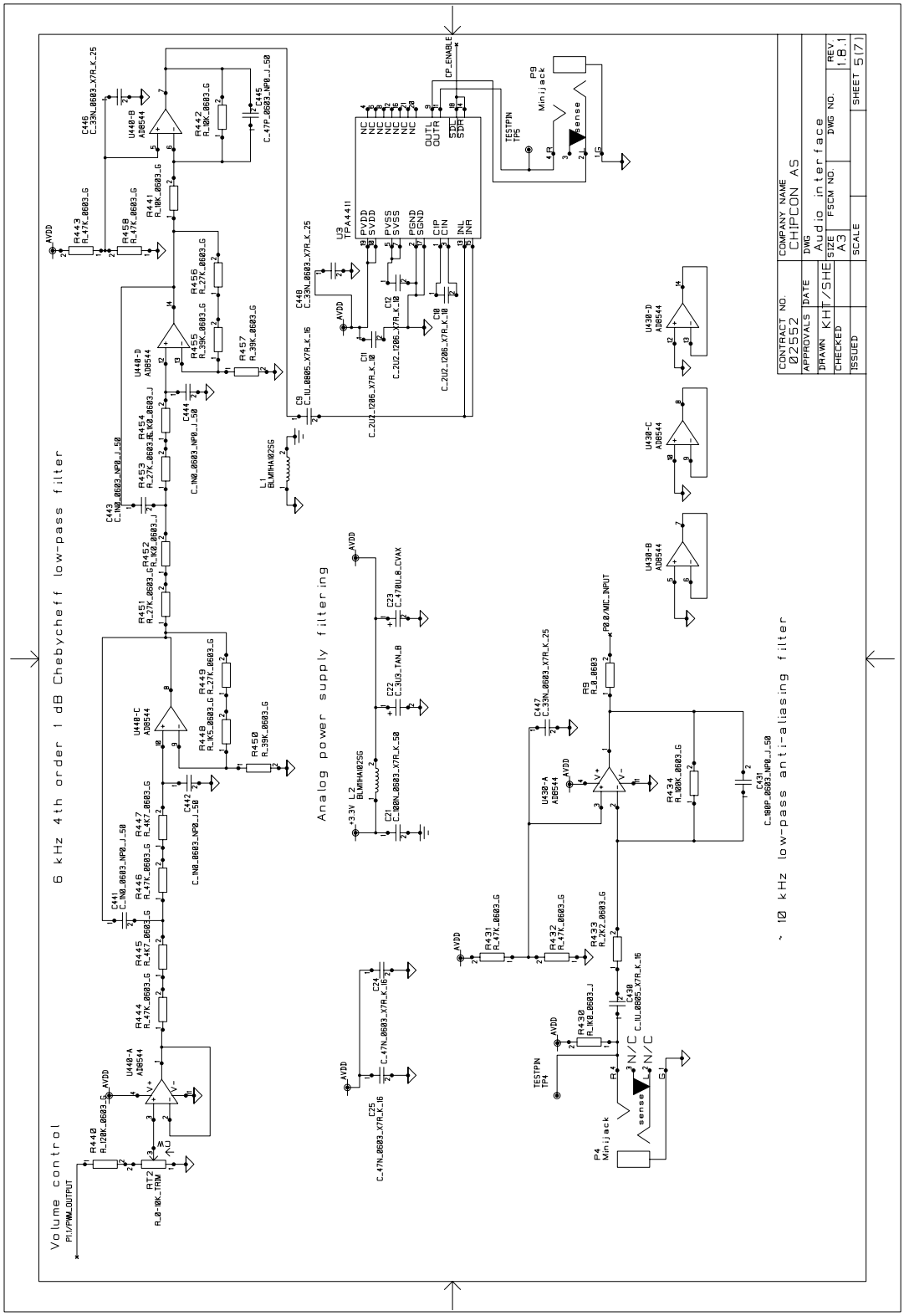


Figure 22: SmartRF®04EB schematic, page 5

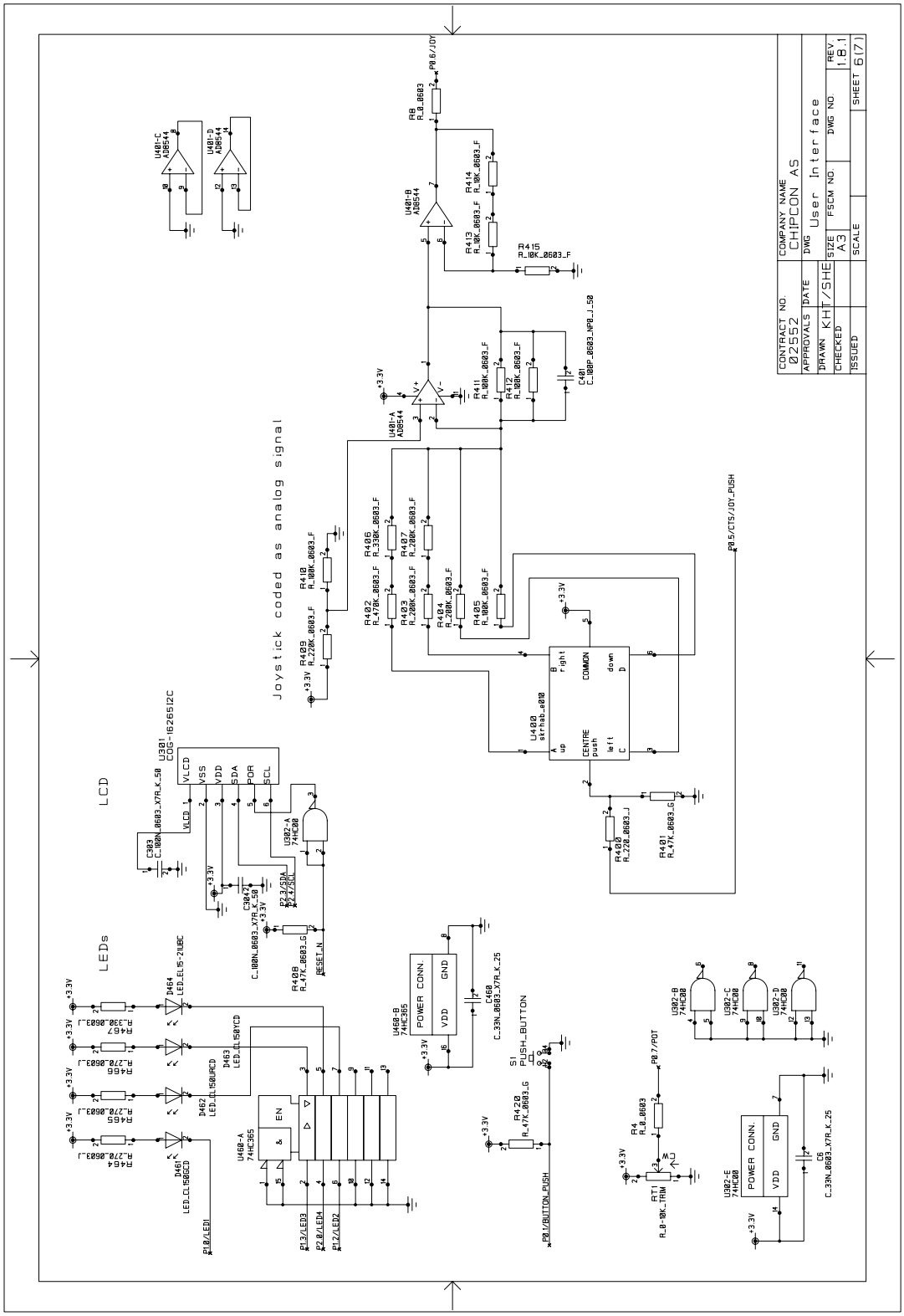


Figure 23: SmartRF®04EB schematic, page 6

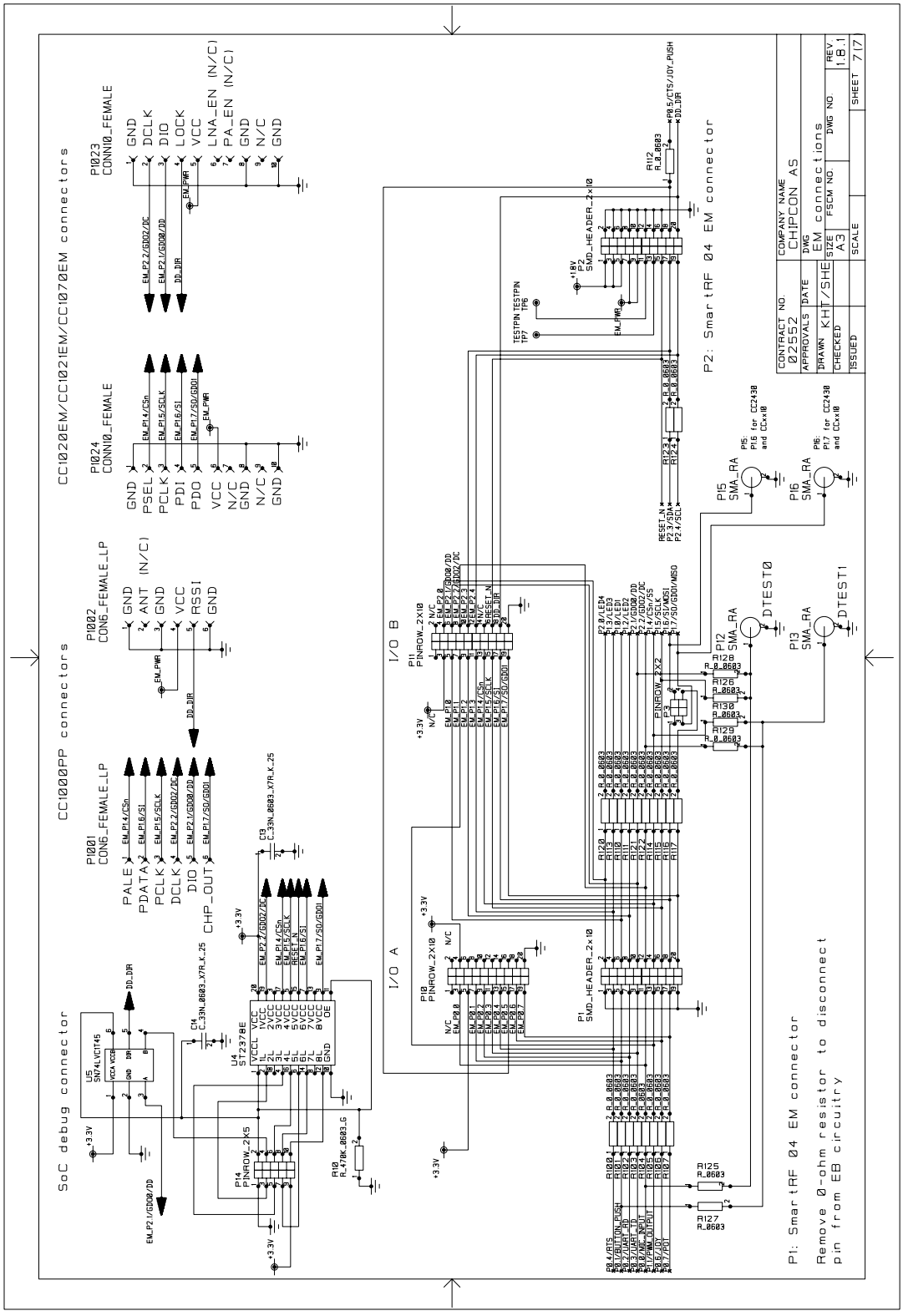


Figure 24: SmartRF®04EB schematic, page 7

Revision	Description/Changes
2.0.1 (PCB 1.9)	R104 not mounted by default, see section 6.5
2.0 (PCB 1.9)	Changes to production test, no physical changes to product.
1.9 (PCB 1.9)	Initial public release

Table 5: SmartRF®04EB change list

13 Evaluation Modules

Gerber files and full documentation for the released evaluation modules can be downloaded from the Texas Instruments web site.

Figure 25: Evaluation Module

14 Document history

Revision	Date	Description/Changes
a	2007-10-10	Updated information concerning the CC1110-CC1111DK.
-	2007-09-14	Initial release. This user manual previously covered CC1110, CC2510 and CC2430 (swru039). It has now been separated into two documents; one for CC1110/2510 and another for CC2430. The main technical update in this document revision concerns the debug interface, audio interface and software examples.

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